

Nematode Parasites from Marine Fishes of Okinawa, Japan

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ABSTRACT: *Paracapillaria sesokoensis* sp. n. is described from *Fistularia petimba*, *Cucullanus okinawanus* sp. n. from *Echidna delicatula*, and *Dichelyne* (*Neocucullanellus*) *laticeps* is redescribed from *Arothron mappa*. *Paracapillaria sesokoensis* is distinguished from other members in the genus by the shape and measurement of spicule, and *C. okinawanus* is readily distinguished from other representatives in the genus by its stout spicules and body dimensions. *Spirocamallanus istiblenni*, *Heliconema baylisi*, and *D. (N.) laticeps* are recorded from Okinawan fishes for the first time, and their presence suggests that the fish nematode fauna of this area has characteristics of the Indo-Polynesian Province of the Indo-West Pacific Region. Nematodes rarely occurred in the Okinawan shore fishes examined.

KEY WORDS: Nematoda, *Paracapillaria sesokoensis* sp. n., *Cucullanus okinawanus* sp. n., *Dichelyne* (*Neocucullanellus*) *laticeps* redescription, coral reefs, survey, fish, Okinawa, Japan, new hosts, new localities, habitat.

Few reports are available on the parasitic nematode fauna of marine fishes of Okinawa (cf. Yamaguti, 1941). Because of the need for additional information on the helminths of marine fishes of this area, the junior authors examined various fishes as listed by Dyer et al. (1988a, 1989) during their stay as invited researchers at the Sesoko Marine Science Center, University of the Ryukyus, from 27 May 1985 through 20 March 1986. This paper reports the nematodes collected from these fishes with descriptions of new species and new geographical and host records. Some other groups of parasites from these examinations that have been reported include: Digenea (Dyer et al., 1988a, b), Monogenea (Dyer et al., 1989), barnacles (Williams and Williams, 1986b), and nudibranchs (Williams and Williams, 1986a).

Materials and Methods

Fishes were collected with spearguns (Williams and Williams, 1986). They were either examined immediately or held alive and examined within 24 hr of capture. The alimentary system, coelomic cavity, gills, swim bladder, urinary bladder, and skin of all fishes were examined. Nematodes were fixed in AFA solution, prepared by the standard glycerin alcohol method, and mounted with 50% glycerin aqueous solution. Figures were made with the aid of a drawing tube. Measurements of holotypes and allotypes are followed by ranges for paratypes in parentheses. All measurements are in micrometers unless otherwise stated. Specimens of all nematode species are deposited in the United States National Museum Helminthological Collection (USNM). The following material was also examined: *Spirocamallanus istiblenni* Noble, 1966, syntypes (1 male and 1 female), USNM 72590 and 72591; *Spirocamallanus philippinensis* Machida and Taki, 1985 (3 males and 3 females), National Science Museum,

Tokyo, NSMT As-1802; *Dichelyne* (*Neocucullanellus*) *laticeps* Baylis, 1948, syntypes (2 males and 3 females), British Museum (Natural History), Reg. No. 1950.12.6. 167–178.

Results

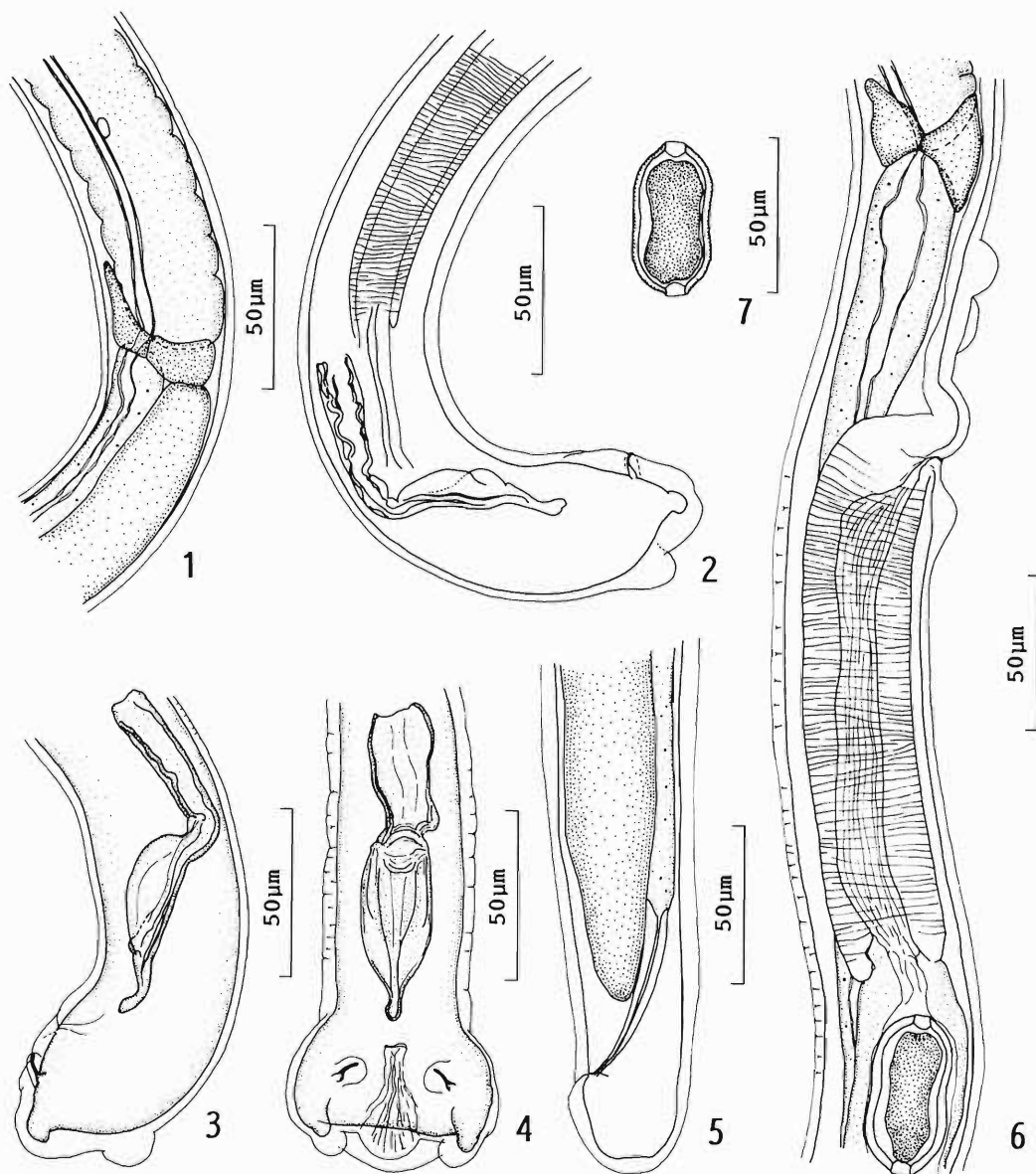
Nine species of nematodes were collected from 27 specimens of 24 species of fishes (Table 1). Nematodes occurred in 9.3% of the specimens and 12.9% of the species of fishes examined.

Paracapillaria sesokoensis sp. n. (Figs. 1–7)

Trichinelloidea, Trichuridae, Capillariinae.

Body slender, threadlike, forming complex tangles. Cuticle thin, with fine transverse striations. Anterior part extremely thin with pointed apex. Muscular esophagus short followed by stichocytes in single row. Stichocytes uniform in color, each with transverse annuli and small nucleus (Fig. 1). Esophago-intestinal junction with 2 glandular cells (Figs. 1, 6). Lateral bacillary bands present (Figs. 4, 6).

MALES (holotype and 1 paratype): Length 17 (18) mm and maximum width 48 (48) at about 4 mm anterior to posterior extremity. Nerve ring 106 from anterior extremity. Muscular esophagus 294 long. Esophago-intestinal junction 11.5 (10.7) mm from anterior extremity. Posterior extremity expanded laterally forming bursate structure; 1 pair of small papillae projecting ventrally and 1 pair of stout papillae present at posterior apex (Figs. 2–4). Spicule stout, short, bent ventrally, with lateral thickenings in distal half, with



Figures 1–7. *Paracapillaria sesokoensis* sp. n. from *Fistularia petimba*. 1. Esophago–intestinal junction of male (holotype), lateral view. 2. Posterior end of male (holotype), lateral view. 3. Posterior end of male (paratype), lateral view. 4. Posterior end of male (paratype), ventral view. 5. Posterior end of female (paratype), lateral view. 6. Vulval part of female (paratype), lateral view. 7. Egg.

rounded tip, 95 (100) long (Figs. 2–4). Ejaculatory duct with fine striations, 1.75 (1.69) mm long (Fig. 2).

FEMALE (1 paratype lacking anterior end): Length over 31 mm and maximum width 65 at about 10 mm anterior to posterior extremity. Esophago–intestinal junction 21.3 mm from posterior extremity. Vulva behind esophago–intes-

tinal junction (Fig. 6). Anterior lip of vulva protruded, 2 cuticular elevations in front of vulva and 1 posterior to vulva (Fig. 6). Vagina muscular, directed posteriorly, 167 long (Fig. 6). Anus subterminal, posterior extremity round (Fig. 5). Eggs elliptical, with polar plugs, slightly constricted at middle, surface with fine markings, 48–51 by 23–26 (at widest portion) (Fig. 7).

Table 1. Nematode parasites from marine fishes of Okinawa, Japan.

Species	Host	Size of infected	No. examined/ no. infected	Collection		Number	Location	Parasite	Other parasites
				Locality*	Date				
<i>Fistularia petimba</i>		37.0 cm SL	2/1	<i>Paracapillaria sesokoensis</i> north reef 9 & 17 July 1985		8	intestine	10 immature cestodes 13 <i>Allolepidapedon</i> <i>fistulariae</i> †	
<i>Amphiprion clarkii</i>		10.5 cm SL	2/1	<i>Spirocampaallanus isitibleni</i> southeast 28 May 1985		1	intestine	4 <i>Bucephalopsis ozaki</i> †	
<i>Bohus pantherinus</i>		13.2 cm SL	1/1	southeast	12 March 1986	5 ♀, 9 ♂	intestine	1 digenean	
<i>Paraperis cylindrica</i>		7.7 cm SL	2/1	southeast	28 May 1985	1	intestine	10 <i>Stenurus</i>	
		6.7 cm SL	2/1	southeast	1 & 4 June 1985	1	intestine	<i>magnacetiabulunt</i> †	
<i>Paraperis polyphthalma</i>		11.9 cm SL	1/1	southeast	4 June 1985	2	intestine		
<i>Plectrohynchus pictus</i>		17.0 cm SL	1/1	north coast	12 July 1985	4	intestine	2 <i>Pseudopococelus</i> <i>sesokoensis</i> †	
<i>Scolopsis bilineatus</i>		15.0 cm SL	1/1	southeast	27 May 1985	1 ♀, 2 ♂	intestine		
<i>Soleichthys heterorhinos</i>		6.8 cm SL	1/1	southeast	12 October 1985	1	mid-intestine		
<i>Valencienna sirigata</i>		13.0 & 15.0 cm SL	2/2	north reef	19 July 1985	3	intestine		
<i>Varida albimarginata</i>		32.0 cm SL	2/1	south reef	24 July 1985	5	intestine	37 <i>Proserhynchus</i> <i>platycephali</i> †	
<i>Varida louti</i>		20.5 cm SL	1/1	north coast	12 July 1985	1	intestine	20 <i>P. platycephali</i> †	
<i>Echidna delicatula</i>		49.8 cm TL	1/1	<i>Heliconema baylisi</i> north reef 9 July 1985		50+	stomach	15 <i>Helicoverina</i> <i>quadrorchis</i> †	
<i>Echidna delicatula</i>		49.8 cm TL	1/1	<i>Cucullianus okinawanus</i> north reef 9 July 1985		1 ♀, 1 ♂	intestine	15 <i>H. quadrorchis</i> †	
<i>Arothron mappa</i>		26.5 cm SL	1/1	<i>Dicheilyne laticeps</i> southeast 22 October 1985		5	intestine		
<i>Epinephelus summana</i>		27.9 cm SL	1/1	<i>Philometra</i> sp. north reef 18 & 19 July 1985		1	under skin	4 copepods	
			1/0	southeast	27 June 1985				
<i>Tylosurus crocodilus</i>		63.0 cm SL	1/1	north coast	12 July 1985				
			1/1	southeast	26 June 1985	1	gular rays under skin anal fin rays under skin§	(encysted)	

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Table 1. Continued.

Host		Parasite					
Species	Size of infected	No. ex- amined/ no. in- fected	Collection		Location	Other parasites	
			Locality*	Date			
<i>Epiplatys hoedtii</i>	27.2 cm SL	1/1	<i>Hysterothylacium</i> sp.		1	1 digenea	
			west coast	11 September 1985		immature cestodes	
<i>Hemiochus chrysostomus</i>	12.5 cm SL	2/1	north reef	11 July 1985	1	7 <i>Hysterothylacium</i> sp.†	
		1/0	north reef	30 May 1985			
<i>Amblyglyphidodon leucogaster</i>	11.0 cm SL	1/1	<i>Raphidascaris</i> sp. A				
<i>Lutjanus fulviflamma</i>	24.4 cm SL	1/1	north reef	11 July 1985	1	intestine	
			west coast	11 September 1985	1	ceca	
<i>Saurida gracilis</i>	15.6 cm SL	1/0	north coast	12 July 1985		5 <i>Hamacraadium</i>	
<i>Synodus variegatus</i>	20.9 cm SL	1/1	southeast	3 June 1985	1	<i>lehrini</i> †	
			southeast	4 June 1985	1	1 digenea	
						2 <i>Sterrhurus</i> sp.†	
						immature cestodes	
<i>Gymnothorax flavimarginatus</i>	78.0 cm TL	1/1	<i>Raphidascaris</i> sp. B				
			north coast	4 July 1985	1 ♀, 2 ♂	intestine	
						1 <i>Aporurus</i>	
						<i>acropomalis</i> †	
<i>Diplogrammus xenicus</i>	4.0 cm SL	3/1	Unknown nematodes				
<i>Bathygobius fuscus</i>	4.9 cm SL	3/1	southeast	3, 12 & 13 June 1985	1	intestine	
			southeast	3 July 1985	1	intestine	
						(immature worm, lost)	
						(<i>Spirocacaliaanus</i> sp.?)	

* Localities around Sesoko Island follow Williams and Williams (1986). Southeast = off Sesoko Marine Science Center; north coast = north coast of Sesoko Island; north reef = reefs north of Sesoko Island; south reef = reef extending off south coast of Sesoko Island; west coast = west coast of Sesoko Island.

† Dyer et al., 1988a.

‡ Dyer et al., 1988b.

§ Not removed from host. Fish preserved intact and deposited in USNM Ichthyological Collection by B. B. Collette.

HOST: *Fistularia petimba* Lacépède (Fistulariidae).

SITE IN HOST: Intestine.

SPECIMENS DEPOSITED: Holotype, USNM 81813; paratypes, USNM 81814.

REMARKS. The new species belongs to the genus *Paracapillaria* Mendonça, 1963, because the male lacks a spiny spicular sheath and lateral caudal alae, but has a membranous bursa supported by 2 lateral rays (cf. Moravec, 1986, 1987). Fourteen species have been recognized in the genus and 6 of them are parasitic in fishes (Moravec, 1986, 1987, 1990). *Paracapillaria sesokoensis* differs from all other members of the genus by having a much shorter spicule of characteristic shape (over 0.2 mm in length in other species).

The specimen of *F. petimba* without nematodes and the 1 with *P. sesokoensis* were also infected with 2 different digeneans, 15 *Opecoelus sphaericus*, and 13 *Allolepidapedon fistulariae*, respectively, also both were infected with immature cestodes (3 and 10, respectively), all in the intestine. The *O. sphaericus* occurred in the posterior intestine, while *P. sesokoensis* and *A. fistulariae* occurred throughout.

Spirocamallanus istiblenni Noble, 1966

Camallanoidea, Camallanidae.

MALES (19 specimens): Length 7.6–15.4 mm and maximum width 120–240. Buccal capsule 68–86 long and 52–87 wide. Nerve ring 190–260 and excretory pore 370–590 from anterior extremity. Muscular esophagus 310–420 long and glandular esophagus 380–590 long. Right spicule 220–290 long, left spicule 150–200 long. Tail 120–230 long.

FEMALES (10 specimens): Length 9.4–25.7 mm and maximum width 150–420 in midbody. Buccal capsule 75–96 long and 67–75 wide. Nerve ring 240–310, excretory pore 400–660 and vulva 4.77–11.7 mm from anterior extremity. Muscular esophagus 390–470 long and glandular esophagus 400–680 long. Tail 150–190 long. Eggs 40–42 by 27–31.

HOSTS: *Amphiprion clarkii* (Bennett) (Pomacentridae), *Bothus pantherinus* (Ruppell) (Bothidae), *Parapercis cylindrica* (Bloch) (Mugiloididae), *Parapercis polyophtalma* (Cuvier) (Mugiloididae), *Plectorhynchus pictus* (Thunberg) (Pomadasyidae), *Scolopsis bilineatus* (Bloch) (Nemipteridae), *Soleichthys heterorhinos* Bleeker (Soleidae), *Valenciennesa strigata* (Broussonet)

(Gobiidae), *Variola albamarginata* Baissac (Serranidae), *Variola louti* (Forsskal) (Serranidae).

SITE IN HOST: Intestine.

SPECIMENS DEPOSITED: USNM 81815–81824.

REMARKS: Although the present worms have a somewhat longer esophagus, morphological characteristics are otherwise identical to those in the original description and of type specimens of *S. istiblenni* from *Istiblennius zebrae* (Blennidae) in Hawaii (Noble, 1966). The fishes listed above are recorded for the first time as hosts of *S. istiblenni*. *Spirocamallanus istiblenni* resembles *Spirocamallanus philippinensis* Machida and Taki, 1985, from *Siganus guttatus* (Siganidae) of the Philippines in general morphology, but is distinguished in that the mature adults of the latter species have much larger body (males 17.6–19.8 mm long and females 32.7–40.1 mm long; Machida and Taki, 1985).

Spirocamallanus istiblenni seems to have little host specificity, occurring in 8 families of fishes in our study. It also seemed to be widespread in habitat preferences, occurring in all localities around Sesoko Island (Table 1). The food habits of these hosts, which would presumably be important in transmission to the final host, varied from large predators and minipredators, through generalists and herbivores (Williams and Williams, 1986).

The 5 specimens of *S. istiblenni* in *V. albamarginata* occurred in the posterior intestine while 22 specimens of *Proisorhynchus platycephali* (Digenea) (Dyer et al., 1988a) occupied the mid-intestine and 17 in the anterior intestine. This sort of habitat differentiation was not noted in other digeneans associated with this nematode. Two *Sterrhurus* sp. occurred in the stomach of a second *V. albamarginata* (Dyer et al., 1988a).

Heliconema baylisi Ogden, 1969

Physalopteroidea, Physalopteridae, Proleptinae.

MALES (10 specimens): Length 21–37 mm and maximum width 300–530. Diameter of head 104–127. Buccal cavity 30–44 long. Nerve ring 260–330, excretory pore 450–600 and deirids 250–350 from anterior extremity. Muscular esophagus 440–570 long and glandular esophagus 2.42–3.62 mm long. Right spicule 350–410 long, left spicule 380–500 long, and spicule ratio 1:1.05–1.22. Tail 380–550 long.

FEMALES (8 specimens): Length 15–40 mm and maximum width 280–620. Diameter of head

99–147. Buccal cavity 31–50 long. Nerve ring 220–350, excretory pore 350–550 and deirids 240–400 from anterior extremity. Muscular esophagus 370–570 long and glandular esophagus 2.50–4.42 mm long. Vulva 9.2–21.5 mm from anterior extremity. Tail 200–280 long. Eggs 40–42 by 27–31.

HOST: *Echidna delicatula* (Kaup) (Muraenidae).

SITE IN HOST: Intestine and stomach.

SPECIMENS DEPOSITED: USNM 81825.

REMARKS: *Heliconema baylisi* was originally described from *Echidna nebulosa* caught at Cocos Keeling Island, Indian Ocean (Ogden, 1969). Fusco and Palmieri (1980) stated that the average spicule ratio of *H. baylisi* is 1:1.5. However, this value may be incorrect because the spicule ratio calculated from the original data by Ogden (1969) is 1:1.11–1.36. The present specimens are morphologically identical with the original description of *H. baylisi*, but some worms are much larger (cf. Ogden, 1969). *Echidna delicatula* represents a new host.

More than 50 *H. baylisi* were attached in the anterior stomach of *E. delicatula*. Fifteen specimens of *Helicometrina quadrorchis* (Dyer et al., 1988a) occurred in the anterior intestine and 2 specimens of *Cucullanus okinawanus* were found in the posterior intestine of the same host.

***Cucullanus okinawanus* sp. n.
(Figs. 8–15)**

Seuratoidea, Chitwoodchabaudiidae, Cucullininae.

Body stout with maximum width at midbody. Cuticle thin, with fine transverse striations. Lateral alae present. Pseudobuccal cavity relatively developed; inner surface with numerous minute tubercles; Y-shaped suture present; transverse ventral plate small; reniform structures and dorsal arrow-shaped structures well developed (Figs. 8–10). Four submedian papillae and amphids present (Figs. 9, 10), 6 inner labial papillae present. Mouth dorsoventrally slitlike, bordered by collarete bearing many teeth on inner surface (Figs. 9, 10). Esophagus club-shaped; posterior width larger than anterior width in lateral view (Fig. 8). Nerve ring at anterior $\frac{1}{3}$ of esophagus (Fig. 8). Deirids prominent, at posterior $\frac{1}{3}$ of esophagus (Fig. 8). Excretory pore near esophago-intestinal junction (Fig. 8); excretory system with relatively long terminal duct connecting posteriorly small sinus from which 2 anteriorly

directed and 2 posteriorly directed lateral canals arise (Fig. 11). Intestinal cecum absent.

MALE (holotype): Length 7.6 mm and maximum width 220. Esophagus 750 long, anterior width 140 and posterior width 180. Nerve ring 260, excretory pore 720 and deirids 590 from anterior extremity. Ventral sucker without cuticular rim present preanally (Fig. 12). Tail conical, narrowed abruptly at a short distance behind anus, 210 long (Fig. 12). Caudal alae absent. Ten pairs of sessile papillae present in caudal region: anterior 4 pairs well spaced; 1st pair anterior to sucker; 2nd pair posterior to sucker; 3rd pair midway between sucker and anus; 4th to 6th pairs grouped adanally; 7th and 8th pairs positioned laterally; 9th and 10th pairs near tail tip (Fig. 12). Spicules subequal, stout, well chitinized, widest at midportion, tapering to both ends, and pointed distally; right spicule 390 long and left spicule 400 long (Fig. 12). Gubernaculum well chitinized, Y-shaped in ventral view, 127 long.

FEMALE (allotype): Length 9.9 mm, maximum width 300. Esophagus 890 long, anterior width 150 and posterior width 210. Nerve ring 300, excretory pore 790 and deirids 580 from anterior extremity. Vulva 5.95 mm from anterior extremity. Amphidelphic; vagina directed anteriorly, then flexed posteriorly (Fig. 13). Tail conical, abruptly narrowed behind anus, 234 long (Fig. 14). Eggs elliptical, thin-shelled, containing 1- to 2-cell stage embryos at deposition, 65–71 by 35–42 (Fig. 15).

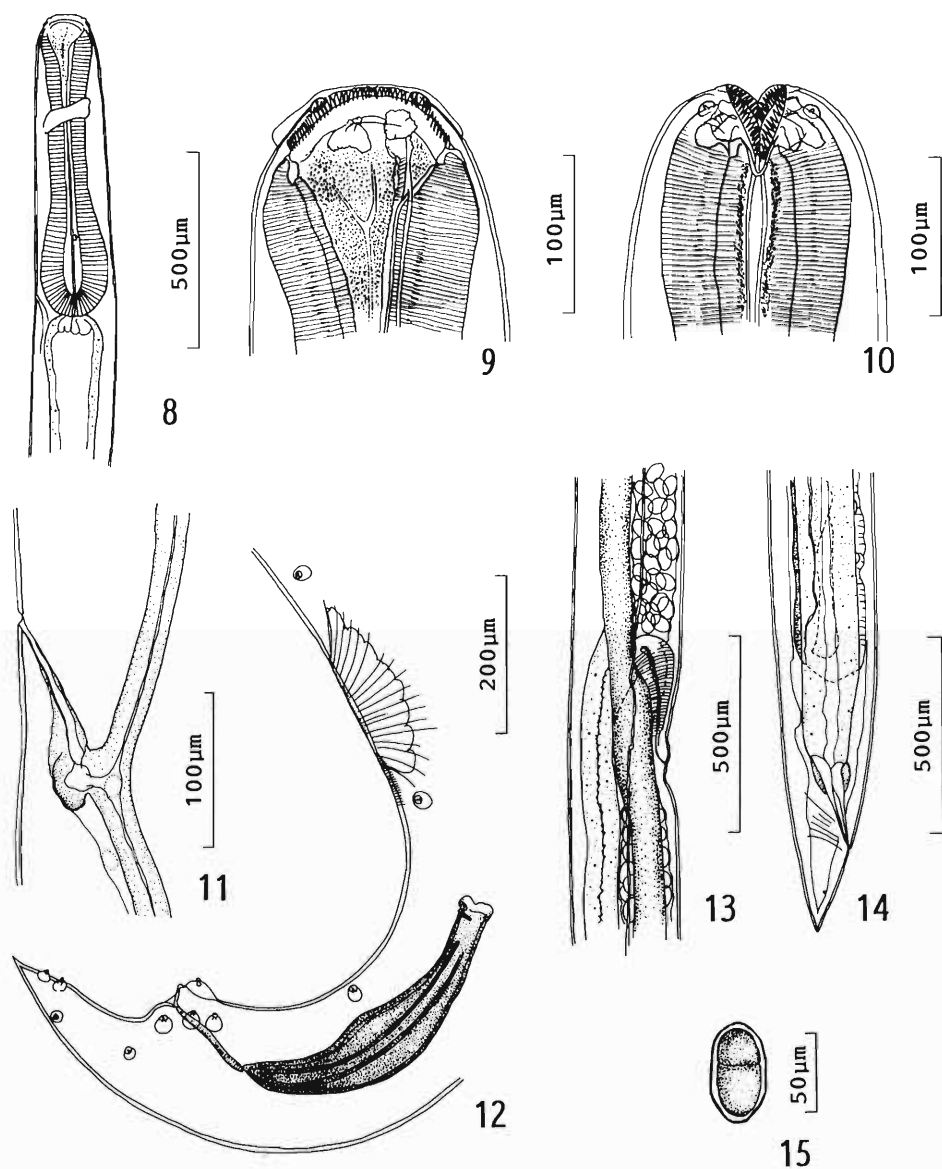
HOST: *Echidna delicatula* (Kaup) (Muraenidae).

SITE IN HOST: Intestine.

SPECIMENS DEPOSITED: Holotype and allotype, USNM 81826.

REMARKS: The new species belongs to the genus *Cucullanus* Mueller, 1777, in having a developed pseudobuccal cavity with Y-shaped suture and dorsoventrally elongated mouth, and in lacking intestinal cecum and alae in male tail (cf. Chabaud, 1978). Petter (1974b) revised the family Cucullanidae Cobbold, 1864, and recognized 68 species in the genus *Cucullanus*. Subsequently, 31 species have been added in the genus. From Okinawan waters, *Cucullanus himezi* Yamaguti, 1941, has been described from *Upeneu bensasi* (Mullidae) (Yamaguti, 1941).

Cucullanus antipodeus Baylis, 1932, *C. bagre* Petter, 1974, *C. caballeroi* Petter, 1977, *C. chrysophrydis* Gendré, 1927, *C. micropapillatus*



Figures 8–15. *Cucullanus okinawanus* sp. n. from *Echidna delicatula*. 8. Anterior part of female (allotype), lateral view. 9. Anterior extremity of female (allotype), lateral view. 10. Anterior extremity of female (allotype), ventral view. 11. Excretory system, lateral view. 12. Posterior end of male (holotype), lateral view. 13. Vulval part of allotype, lateral view. 14. Posterior end of female (allotype). 15. Egg.

Törnquist, 1931, *C. muraenesocis* Yamaguti, 1961, *C. murenophidis* Campana-Rouget, 1957, *C. pseudeutrophi* Agrawal, 1967, *C. quadrii* Bliques and Fatima, 1980, and *C. vachai* Gupta and Bakshi, 1983, resemble *C. okinawanus* by having males with a preanal sucker and spicules shorter than 0.5 mm. However, all except *C. murenophidis* are readily distinguished from *C.*

okinawanus by having spicules with parallel sides, lacking markedly expanded middle portion (cf. Yamaguti, 1961; Petter, 1974a, 1977; Ivashkin and Khromova, 1976; Bilques and Fatima, 1980; Gupta and Bakshi, 1983). Although the shape of spicules of *C. murenophidis* has not been described or figured, it differs from *C. okinawanus* in having an excretory pore that is situated pos-

terior to the esophago-intestinal junction, an esophagus which is more inflated anteriorly than posteriorly, and 2 pairs of large papillae on the mid-ventral portion of the tail (Campana-Rouget, 1957).

Cucullanus okinawanus can also be distinguished from the *Cucullanus* species for which males have not been described: *C. callichroi* (Stewart, 1914) has a shorter but thicker body (6.63–7.225 mm long by 0.39–0.43 mm wide) and larger eggs (85 by 56); *C. carangis* (MacCallum, 1921) has an esophagus, the anterior portion of which is much wider than the posterior; *C. girellae* Yamaguti, 1941, is a much larger worm (19–20 mm long) with larger eggs (75–81 by 41–45); *C. bilqeesi* Petter, 1974, has 5 finger-like projections in the pseudobuccal cavity (cf. MacCallum, 1921; Yamaguti, 1941; Bilqeess et al., 1971; Ivashkin and Khromova, 1976).

Dichelyne (Neocucullanellus) laticeps

Baylis, 1948

(Figs. 16–29)

Seuratoidea, Chitwoodchabaudiidae, Cucullaninae.

Body relatively stout, widest at postesophageal portion and tapering to both extremities. Cuticle thick, with fine transverse striations; lateral alae absent. Prominent somatic papillae with rounded tips (Fig. 20) and intracuticular papilla-like structures (Fig. 21) scattered on body. Cephalic extremity slightly inclined ventrally (Fig. 16). Pseudobuccal cavity relatively developed; inner surface with numerous minute tubercles; Y-shaped suture present; transverse ventral plate small; reniform structures and dorsal arrow-shaped structures small (Figs. 17–19). Four submedian papillae and amphids present, 6 small inner labial papillae present (Figs. 17–19). Mouth dorsoventrally slitlike, bordered by collarlike bearing many minute teeth on inner surface (Fig. 17). Esophagus club-shaped, anterior width larger than posterior width (Fig. 16). Intestinal cecum present on dorsal side of esophagus (Fig. 16). One pair of well-developed cervical glands present laterally extending to mid-esophagus (Fig. 16). Nerve ring immediately posterior to pseudobuccal cavity (Fig. 16). Deirids sharply pointed, posterior to cervical glands (Figs. 16, 22). Excretory pore anterior to posterior end of esophagus (Fig. 16); excretory system with extremely short terminal duct attached to posteriorly directed sinus from which 2 anteriorly di-

rected and 2 posteriorly directed lateral canals arise (Figs. 23, 24).

MALE (1 specimen): Length 11.7 mm and maximum width 380. Esophagus 880 long, anterior width 210 and posterior width 120. Intestinal cecum 630 long. Nerve ring 330, excretory pore 980, deirids 860 from anterior extremity. Oblique muscular bands present anterior to anus. Tail conical, with pointed tip, 170 long (Figs. 25, 26). Eleven irregular pairs of caudal papillae present: 8 pairs preanal and 3 pairs postanal; 1st to 6th pairs well spaced; 6th, 8th and 9th pairs set closely; 7th pair situated laterally; 10th and 11th pairs near posterior end (Figs. 25, 26). In addition, 1 pair of small papillae and 1 unpaired median papilla present on anterior anal lip (Fig. 26). Phasmids at middle of tail (Fig. 26). Spicules weakly chitinized, simple, slender, tapering distally; each distal end forming a small hook (Fig. 25). Right spicule 1.59 mm long, left spicule 1.52 mm long. Gubernaculum rodlike in lateral view, 82 long (Fig. 25).

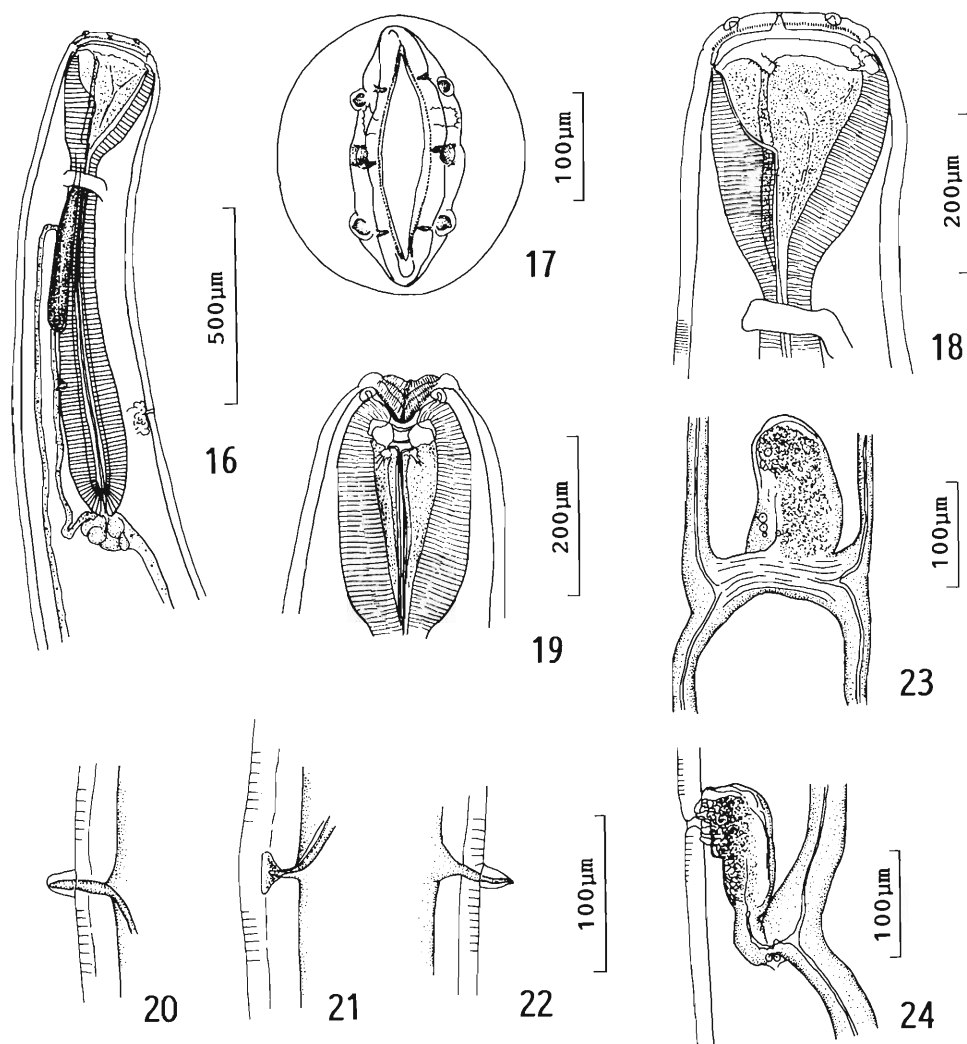
FEMALES (4 specimens): Length 9.8–16.8 mm and maximum width 360–670. Esophagus 1.00–1.30 mm long, anterior width 190–260 and posterior width 120–170. Intestinal cecum 660–880 long. Nerve ring 310–370, excretory pore 0.87–1.03 mm, deirids 780–960 from anterior extremity. Vulva 5.28–8.93 mm from anterior extremity (Fig. 27). Amphidelphic, vagina muscular, 370–760 long, directed anteriorly and joining to uteri (Fig. 27). Tail conical, with prominent phasmids at middle, tip hornlike, 200–250 long (Fig. 28). Eggs elliptical, thin-shelled, containing 1- to 2-cell stage embryo at deposition, 55–60 by 40–45 (Fig. 29).

HOST: *Arothron mappa* (Lesson) (Tetraodontidae).

SITE IN HOST: Intestine.

SPECIMENS DEPOSITED: USNM 81827.

REMARKS: *Dichelyne (N.) laticeps* is the only representative of the subgenus *Neocucullanellus* parasitic in Tetraodontiformes (Petter, 1974b). This species was first described from *Arothron hispidus* (syn. *Tetraodon hispidum*) from Cleveland Bay, North Queensland, Australia (Baylis, 1948). This species was in need of redescription because the original type materials were shrunk and distorted by being mounted in Canada balsam (Baylis, 1948). The present specimens are somewhat larger and have longer spicules but otherwise agree with the type specimens and the original description. The spicules are about 1 mm



Figures 16–24. *Dichelyne* (*Neocucullanellus*) *laticeps* Baylis, 1948, from *Arothron mappa*. 16. Anterior part of female, lateral view. 17. Anterior extremity of female, apical view. 18. Anterior extremity of female, lateral view. 19. Anterior extremity of female, ventral view. 20. Somatic papilla. 21. Intracuticular papilla-like structure. 22. Deirid. 23. Excretory system, ventral view. 24. Excretory system, lateral view.

in the original description (Baylis, 1948). In the type specimens, the spicules have numerous wrinkles, which may have resulted from distortion of these weakly chitinized structures.

From Okinawan waters *Dichelyne* (*Neocucullanellus*) *apharesi* Yamaguti, 1941, has been described from *Aphareus furcatus* (Lutjanidae) (Yamaguti, 1941). *Dichelyne* (*N.*) *laticeps* is readily distinguished from *D. (N.) apharesi* by the dorsal position of the intestinal cecum (ventral side in *D. (N.) apharesi*) and larger body (males 3.5–4.9

mm long and females 4.0–6.43 mm long in *D. (N.) apharesi*) (Yamaguti, 1941).

Philometra sp. (mature female)

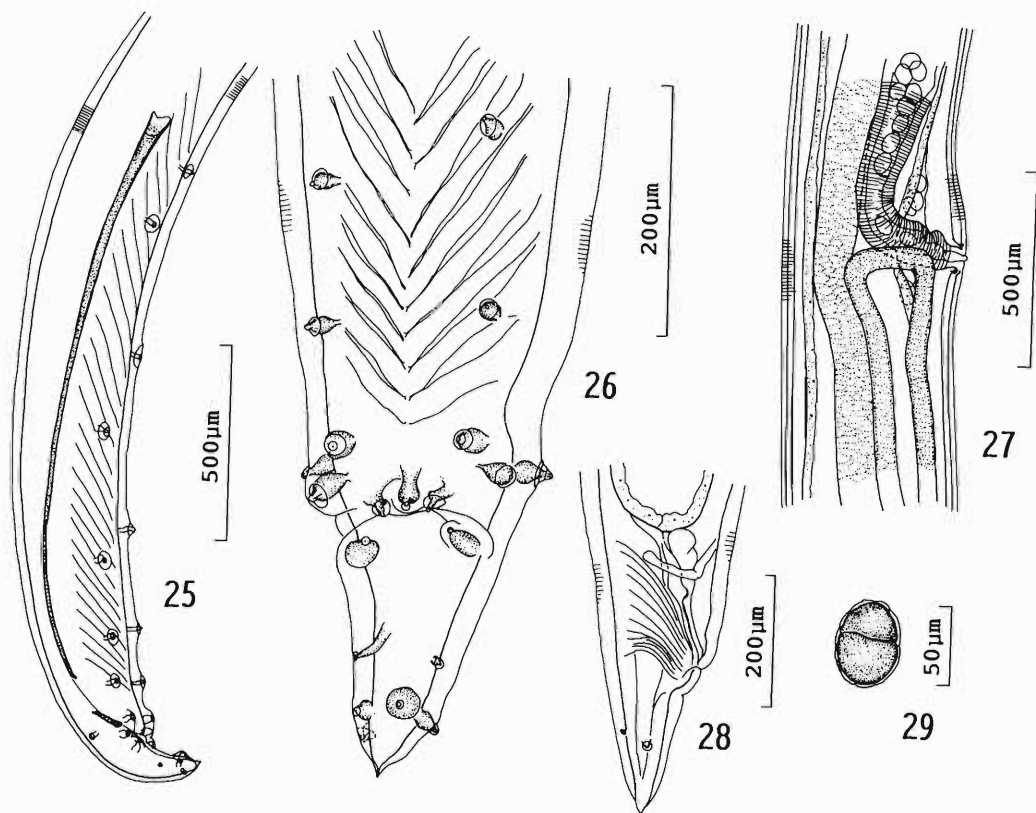
Dracunculoidea, Philometridae.

HOSTS: *Epinephelus summana* (Forsskål) (Serranidae), *Tylosurus crocodilus* (Lesueur) (Belontiidae).

SITE IN HOST: Under skin.

SPECIMENS DEPOSITED: USNM 81828, 81829.

REMARKS: This red-colored nematode can be



Figures 25–29. *Dichelyne* (*Neocucullanellus*) *laticeps* Baylis, 1948 from *Arothron mappa*. 25. Posterior part of male, lateral view. 26. Posterior extremity of male, ventral view. 27. Vulval part of female, lateral view. 28. Posterior end of female, lateral view. 29. Egg.

observed easily through the skin of the host in the gular areas or fin rays (Table 1).

***Hysterothylacium* sp.
(larva or immature adult)**

Ascaridoidea: Anisakidae.

HOSTS: *Epinephelus hoedtii* (Bleeker) (Serranidae), *Heniochus chrysostomus* Cuvier (Chaetodontidae).

SITE IN HOST: Intestine and stomach.

SPECIMENS DEPOSITED: USNM 81830, 81831.

***Raphidascaris* sp. A (adult)**

Ascaridoidea: Anisakidae.

HOSTS: *Amblyglyphidodon leucogaster* (Bleeker) (Pomacentridae), *Lutjanus fulviflamma* (Forsskal) (Lutjanidae), *Saurida gracilis* (Quoy and Gaimard) (Synodontidae), *Synodus variegatus* (Lacépède) (Synodontidae).

SITE IN HOST: Intestine and ceca.

SPECIMENS DEPOSITED: USNM 81832–81835.

***Raphidascaris* sp. B (larva)**

Ascaridoidea: Anisakidae.

HOST: *Gymnothorax flavimarginatus* (Ruppell) (Muraenidae).

SITE IN HOST: Intestine.

SPECIMENS DEPOSITED: USNM 81836.

Discussion

Okinawa is located in the middle of the Ryukyu Archipelago which lies between Taiwan and the mainland of Japan. Marine zoogeographically, Okinawa belongs to the Indo-Polynesian Province of Indo-West Pacific Region, and most marine fishes of Okinawa are shared with the subtropical and tropical West Pacific and Indian oceans (cf. Briggs, 1974). It is thus natural that some of the nematode parasites recorded in this study, namely *S. istiblenni*, *H. baylisi*, and *D. (N.) laticeps*, are shared with Okinawan and Tropical Pacific or Indian Ocean fishes. A similar

pattern was noted in the trematode fauna of Okinawa (Dyer et al., 1988a, 1989): among 12 species of monogeneans recorded 5 had been described from Sulawesi waters, and among 34 digenean species collected, 7 had been reported from Sulawesi, Philippines, and Tropical Pacific waters (cf. Yamaguti, 1963, 1970).

The nematodes in subtropical Okinawan shore fishes seemed to occur rather rarely compared to those the junior authors have examined in similar fishes in the temperate northern Gulf of Mexico (Williams, 1983) and tropical Puerto Rico and other Caribbean locations (Bashirullah and Williams, 1980; Williams, 1983; Dyer et al., 1985). Similar results were obtained by Myers and Kuntz (1967) in Taiwan waters, which are south of Okinawa. They examined many marine fishes including shore fishes, but most nematodes collected were larval or immature forms, and few species of mature nematodes, i.e., *Procamallanus sigani* Yamaguti, 1935, *Rhabdochona* sp., and *Spinitectus* sp., occurred. The marine shore fishes of the Ryukyu Archipelago-Taiwan areas seem to have a depauperate nematode fauna.

Acknowledgments

We thank K. Yamazato, Sesoko Marine Science Center and the Ministry of Education, Science and Culture of the Japanese Government for support of this research. We also thank J. Ralph Lichtenfels, National Parasite Collection, USDA, D. I. Gibson, British Museum (Natural History), and M. Machida, National Science Museum, for the loan of the specimens; T. Yoshino, University of the Ryukyus, for his kind discussion on marine zoogeography of fishes; and A. Ichihara, Meguro Parasitological Museum, for his kindness in supplying copies of related papers. This is a contribution of the Sesoko Marine Science Center.

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